The Drawings

Applicants are submitting herewith corrected drawings labeling Figures 1-5 "Prior Art."

Rejection Under 35 U.S.C. §102

On page 2 of the Office Action the Examiner rejected all claims under 35 U.S.C. §102 as anticipated by U.S. Patent 4,558,465 to Siegel et al.

The Siegel et al. patent is directed to a switched bias scheme for a high speed laser transmitter. Referring to Figure 2 which is relied upon by the Examiner, this Figure is a block diagram of the logic required to perform a periodic refresh cycle in which both a bias current I_B and a modulation current I_M are used for a period of time (column 3, lines 32-37). Siegel et al. describes that during normal operation the values of I_B and I_M are retained in programmable current sources 186 and 154. Two switches 188 and 156 remain open circuited until a data burst occurs, so that neither I_B nor I_M are supplied to the laser diode 162 until such data burst occurs. Thus, the laser diode 162 is completely off in the absence of a data burst during normal operation. When a data burst occurs, a pre- biasing gating signal is supplied via lead 196 through an OR gate 192 to the switch 188 immediately before the data burst to permit Ib to flow from current source 186 to laser diode 162. The data burst follows immediately thereafter and is supplied via a lead 180.

During high level portions of the data, the switch 156 is closed to permit the current I_M generated in a source 154 to be supplied to the laser diode 162. During low level portions of the data, the switch 156 is open circuited to prevent the flow of I_M from source 154 to laser diode 162 (see column 4, line 46 to column 5, line 4. Thus, in Siegel et al., the bias current is supplied to the laser diode immediately before or during the data burst. At all other times the bias current is set to have a zero value so that the emitted light output of the laser diode is kept at zero, thereby avoiding residual laser light in an optical fiber. In addition, Siegel discloses that the setting of the bias current and the modulation current is periodically updated during required cycles to compensate for deterioration with time of the laser diode.

In rejecting the claims, the Examiner takes the position that the features of claim 1 are anticipated by the driving circuit of Siegel et al. which has a pre-bias gating signal 196, a bias current I_B and a modulation current I_M.

Claim 1

Referring to claim 1, it is submitted that Siegel et al. does not teach or suggest:

> first bias current supply means for generating, at least at a time of non-output of data, a first bias current for driving the semiconductor laser in a predetermined area within a spontaneous emission area, to supply the first bias current to the semiconductor laser;
>
> signal processing means for generating a pulse current control signal in which the data signal is delayed, using only the data signal, and generating a second bias current control signal that rises more rapidly by a predetermined time than the rise of the burst data included in the pulse current control signal;

The Examiner appears to take the position that the pre-bias gating signal in Siegel et al. corresponds to the first bias current which is generated to drive the semiconductor laser at least at a time of non-output of data. However, as described in column 4, line 55-60, for example, the pre-bias gating signal in Siegel et al. is a signal supplied via the lead 196 through the OR gate 192 to the switch 188 immediately before a data burst occurs. The switch 188 operates in accordance with the pre-bias gating signal. As a result, the bias current I_B is supplied from the current source 186 to the laser diode 162, therefore, the pre-bias gating signal is <u>not</u> the claimed first bias current for driving the semiconductor laser, but rather the control signal which determines the supply timing of the bias current I_B. Further, as described at column 4, lines 46-55, in Siegel et al., neither the bias current I_B nor the modulation current I_M is supplied to the laser diode during normal operation until a data burst occurs. The laser diode is completely off during the absence of the data burst. Therefore, it is clear that the above-recited "first bias current supply means" is not found in Siegel et al.

It is also submitted that in the present invention, the claimed second bias current control signal rises more rapidly by a predetermined time than the rise of the burst data included in the pulse current control signal. This is done by delaying the data signal. In contrast, in Siegel et al., the pre-bias current rises in accordance with the pre-bias gating signal which is externally provided, separate from the data signal. As shown in the circuit configuration in Figure 2, and the way forms 4A and 4C of Siegel et al., it is clear that as discussed above, the bias current I_B

in Siegel et al. is the current generated in accordance with the pre-bias gating signal and the pre-bias gating signal is different from the data signal.

In summary, for the above reasons, it is submitted that claim 1 patentably distinguishes over the prior art.

Claims 2-12

Claims 2-12 depend, directly or indirectly from claim 1 and include all of the features of that claim plus additional features which are not taught or suggested by the prior art. Therefore, it is submitted that claims 2-12 also patentably distinguish over the prior art.

Claim 13

Claim 13 is directed to a method for driving a semiconductor laser which comprises:

> generating, at least at a time of non-output of data, a first bias current for driving the semiconductor laser in a predetermined area within a spontaneous emission area, to supply the first bias current to the semiconductor laser;
>
> generating a pulse current control signal in which the data signal is delayed, using only the data signal, and generating a second bias current control signal that rises more rapidly by a predetermined time than the rise of burst data included in the pulse current control signal;

Therefore, it is submitted that claim 13 patentably distinguishes over the prior art.

New Claim 14

New Claim 14 is directed to a method for driving a semiconductor laser which comprises:

> supplying a first bias current for driving the semiconductor laser at least at a time of non-output of data, to drive the semiconductor laser in a spontaneous emission area;

supplying a second bias current to the semiconductor laser prior to data transmission by delaying a data signal; and

supplying a pulse current to the semicondutor laser a predetermined time after commencement of supplying the second bias current.

Therefore, it is submitted that claim 14 patentably distinguishes over the prior art.

Summary

It is submitted that all claims in the application are now in condition for allowance. Reconsideration of the claims and an early notice of allowance are earnestly solicited.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Please AMEND the paragraph beginning at page 1, line 20, as follows:

FIG. 1 shows a construction of an ATM-PON (Passive Optical Network) that has gained attention as one of <u>the</u> systems for realizing an optical access network.

Please AMEND the heading on page 3, line 29, as follows:

[DISCLOSURE] <u>SUMMARY</u> OF INVENTION

Please AMEND the paragraph beginning at page 8, lines 28 to 36, as follows:

In FIG. 6, this driver circuit comprises[;]<u>:</u> a fixed bias current supply section 10 serving as first bias current supply means that applies a fixed bias current Ib1 (first bias current) to a semiconductor laser (LD) 100, a burst data processing section 20 serving as signal processing means that generates, based on burst data (a data signal) from outside, a pre-bias signal Sb corresponding to a second bias current control signal and a pulse signal Sp corresponding to a pulse current control signal, a pulse current supply section 30 serving as pulse current supply means that applies to the LD 100 a pulse current Ip generated in accordance with the pulse signal Sp, and a pre-bias current supply section 40 serving as second bias current control means that applies to the LD 100 a pre-bias current Ib2 (second bias current) generated in accordance with the pre-bias signal Sb.

Please AMEND the paragraph beginning at page 10, lines 31 to page 11, line 3, as follows:

At first, when the LD driving circuit is activated, the fixed bias current supply section 10 is operated and the fixed bias current Ib1 is supplied to the LD 100. This fixed bias current Ib1 is for previously supplying a bias current permitted on the system to the LD 100 when an optical output is not being emitted. Therefore, this must be set to a current value as close as possible to zero (for example, about several 10μA - 1μA) within the spontaneous emission area of the LD 100. As shown in FIG. 9, if the current value Ib1 is considered as a voltage applied to the LD

100, although the current value Ib1 is small, it is required to direct an attention to that a voltage Vb1 of a comparatively large value is applied to the LD 100.

Please AMEND the paragraph beginning at page 11, lines 29 to line 31, as follows:

As shown in FIG. 11, in the burst data processing section 20, the input burst data is respectively input to a delay circuit 21, a rise detection circuit 22 and a continuous zero detection circuit 23. In the delay circuit 21, the burst data is delayed (shifted) by a time corresponding to two cell lengths + a pre-bias bit portion, and the pulse signal Sp as shown in (B) of FIG. 10 is output. The abovementioned pre-bias bit specifies how [faster] <u>fast</u> the pre-bias [signals] <u>signal</u> Sb rises with respect to the rise of the pulse signal Sp, being a value which is previously set corresponding to the operating characteristics and the like of the LD 100.

Please AMEND the paragraph beginning at page 12, lines 12 to page 21, line 3, as follows:

Furthermore, in the continuous zero detection circuit 23, counting of the number of continuous zero levels in the input burst data is performed using a counter or the like. For example, when the number of continuous zeros corresponding to one cell length is detected, a short pulse as shown in (E) of FIG. 10 is output. Then, an output signal from the continuous zero detection circuit 23 is sent to a delay circuit 25 and delayed by a time corresponding to one cell length + a pre-bias bit portion, and a signal as shown in (F) of FIG. 10 is output from the delay circuit 25. Next, the output signal from the delay circuit 25 is sent to a reset input terminal R of the latch circuit 26, and the output from the latch circuit 26, that is, the pre-bias signal Sb shown in (G) of FIG. 10, is reset from the high level to the low level.

Please DELETE the header on page 21, line 13 as follows:

[INDUSTRIAL APPLICABILITY]

IN THE CLAIMS:

Please AMEND the following claims:

1. (ONCE AMENDED) A driver circuit [for a semiconductor laser] for driving a semiconductor laser in accordance with a data signal including data generated in bursts, comprising:

first bias current supply means for generating, at least at a time of non-output of data, a first bias current for driving the semiconductor laser in a predetermined area within a spontaneous emission area, to supply [said] <u>the</u> first bias current to the semiconductor laser;

signal processing means for generating a pulse current control signal in which the data signal is delayed, using only [said] <u>the</u> data signal, and generating a second bias current control signal that rises more rapidly by a predetermined time than the rise of <u>the</u> burst data included in [said] <u>the</u> pulse current control signal;

pulse current supply means for generating a pulse current in accordance with the pulse current control signal generated in said signal processing means, to supply [said] <u>the</u> pulse current to the semiconductor laser; and

second bias current supply means for generating a second bias current for driving the semiconductor laser in a predetermined area within the spontaneous emission area in accordance with the second bias current control signal generated in said signal processing means, to supply [said] <u>the</u> second bias current to the semiconductor laser.

2. (ONCE AMENDED) A driver circuit [for a semiconductor laser] according to claim 1, wherein said first bias current supply means includes a temperature compensation section for changing [said] <u>the</u> first bias current corresponding to characteristic changes in the semiconductor laser due to temperature changes.

3. (ONCE AMENDED) A driver circuit [for a semiconductor laser] according to claim 2, wherein

said temperature compensation section has a thermistor with a resistance value <u>which is</u> [being] changed with temperature fluctuations.

4. (ONCE AMENDED) A driver circuit [for a semiconductor laser] according to claim 1, further comprising:

optical output detection means for detecting the power of light output from the semiconductor laser; and

first bias current control means for feedback controlling an operation of said first bias

current supply means so that the optical output power from the semiconductor laser at the time of non-output of data becomes a constant level, based on a detection result of said optical output detection means.

5. (ONCE AMENDED) A driver circuit [for a semiconductor laser] according to claim 1, wherein

said second bias current supply means has a differential amplification type circuit structure.

6. (ONCE AMENDED) A driver circuit [for a semiconductor laser] according to claim 1, wherein

said second bias current supply means includes a temperature compensation section for changing [said] <u>the</u> second bias current corresponding to characteristic changes in the semiconductor laser due to temperature changes.

7. (ONCE AMENDED) A driver circuit [for a semiconductor laser] according to claim 6, wherein

said temperature compensation section has a thermistor with a resistance value [being] <u>which is</u> changed with temperature fluctuations.

8. (ONCE AMENDED) A driver circuit [for a semiconductor laser] according to claim 1, wherein

said signal processing means generates said second bias current control signal which rises more rapidly, by a time corresponding to a predetermined bit number or a predetermined byte number, than the rise of burst data included in said pulse current control signal.

9. (ONCE AMENDED) A driver circuit [for a semiconductor laser] according to claim 8, wherein

said signal processing means generates said second bias current control signal which is maintained at a high level over at least a predetermined period of the beginning side of the burst data generation period.

10. (ONCE AMENDED) A driver circuit [for a semiconductor laser] according to claim 1,

wherein

said first bias current supply means has a circuit structure the same as for said second bias current control means, and generates said first bias current in accordance with a signal obtained by inverting the second bias current control signal generated by said signal processing section.

11. (ONCE AMEDED) A driver circuit [for a semiconductor laser] according to claim 1, wherein

when a rise time of [said] <u>the</u> second bias current is shorter than a time corresponding to 1 bit length of burst data,

said signal processing means comprises a delay section for delaying [said] <u>the</u> data signal by a predetermined time, and a logical sum operation section for obtaining a logical sum of an output signal from said delay section and [said] <u>the</u> data signal, and outputs the output signal from said delay section as the pulse current control signal, and outputs an output signal from said logical sum operation section as the second bias current control signal.

12. A driver circuit [for a semiconductor laser] according to claim 1, wherein

when the rise time of [said] <u>the</u> second bias current is shorter than a time corresponding to 1 bit length of burst data, and also [said] <u>the</u> second bias current is sufficiently larger than [said] <u>the</u> pulse current,

said signal processing section comprises a delay section for delaying [said] <u>the</u> data signal by a predetermined time, and outputs an output signal from said delay section as the pulse current control signal, and outputs [said] <u>the</u> data signal as the second bias current control signal.

13. (ONCE AMENDED) A [driving] method [for a semiconductor laser] for driving a semiconductor laser in accordance with data signals including data generated in bursts, comprising [the steps of]:

generating, at least at a time of non-output of data, a first bias current for driving the semiconductor laser in a predetermined area within a spontaneous emission area, to supply [said] <u>the</u> first bias current to the semiconductor laser;

generating a pulse current control signal in which [said] <u>the</u> data signal is delayed, using only [said] <u>the</u> data signal, and generating a second bias current control signal that rises more

rapidly by a predetermined time than the rise of burst data included in [said] <u>the</u> pulse current control signal;

generating a pulse current in accordance with [said] <u>the</u> pulse current control signal, to supply [said] <u>the</u> pulse current to the semiconductor la; and

generating a second bias current for driving the semiconductor laser in a predetermined area within the spontaneous emission area in accordance with [said] <u>the</u> second bias current control signal, to supply [said] <u>the</u> second bias current to the semiconductor laser.

ABSTRACT

A driver circuit for a semiconductor laser includes a first bias current supply section supplying, at least at a time of non-output of data, a first bias current to an LD. A signal processing section generates a pulse current control signal in which a burst data signal is delayed, and generates a second bias current control signal which rises more rapidly by a predetermined time than the rise of burst data included in the pulse current control signal . A pulse current supply section supplies to the LD a pulse current generated in accordance with the pulse current control signal. A second bias current supply section supplies to the LD a second bias current generated in accordance with the second bias current control signal.